MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 2, 2016/2017

TCS 3311 – COMPILER DESIGN/ TCP2451 – PROGRAMMING LANGUAGE TRANSLATION

(All Sections / Groups)

27 February 2017
9 AM – 11 AM.
(2 Hours)

INSTRUCTION TO STUDENT

1. Answer **ALL** questions.
2. This question paper has 4 printed pages excluding the front cover.
3. Please print all your answers in the answer booklet provided.

QUESTION 1

(a) Given the following regular expression:

$(a \mid b)? \{v\}^2 (s \mid d)^*$

Draw a NFA that can recognize this regular expression using Thompson's construction approach. The alphabet set is {a, b, v, s, d}.

[10 marks]

(b) Derive the ε-closure of the "start" state in the NFA of question 1(a).

[3 marks]

(c) Convert the NFA of question 1(a) to a DFA using subset construction method. Show the transition table, and your workings. Clearly identify start and final states.

[12 marks]

Continued .....

QUESTION 2

(a) For the following grammar determine if it is:-

i. Ambiguous
ii. Suitable for LL(1) parsing

$S \rightarrow A\ a \mid b$
$A \rightarrow A\ c \mid S\ d \mid \varepsilon$

Your answers must come with justifications to get full marks.

[5 marks]

(b) Draw LL(1) parsing table for the grammar below.

$S \rightarrow S + D \mid S - D \mid D$
$D \rightarrow 0 \mid 1 \mid \ldots \mid 9$

Show all your steps to get full mark.

[10 marks]

(c) Develop a pseudocode named "parse_S()" to parse the production rule *S* in the grammar question 2(b) using LL(1) parser. If it is not possible, give your justifications.

[10 marks]

Continued .....

QUESTION 3

Given the following context free grammar:

whileExp → ***while(*** *boolexpr* ***){*** *statements* ***}***
boolexpr → *identifier* == *identifier* | *identifier* != *identifier* | *identifier* < *identifier* |*identifier* > *identifier*
statements → *statements statement* | ε
statement → ***identifier*** = ***number***;

where

identifier – consists of an alphabet followed by zero or more alphabets or digits
number – consists of one or more repetitions of digits

(a) Write the Java CUP specification file to generate a parser based on this grammar.

[10 marks]

(b) Write the JLex specifications for any THREE (3) lexemes that can be recognized by a scanner for the grammar above. Arrange the lexemes into suitable tokens.

[6 marks]

(c) What are the limitations of a LR(0) parser? Explain with use of examples.

[9 marks]

Continued .....

QUESTION 4

a) There are 4 types of static checking namely type checks, flow-of-control checks, uniqueness checks, name-related checks. Explain all these 4 types of static checking.

[12 marks]

b) Provide a comparison between quadruple, triples, and indirect triples three-address code implementations.

[6 marks]

c) Provide examples for the following peephole optimization techniques:-

i. Eliminate redundant loads and stores
ii. Algebraic Simplifications
iii. Constant folding
iv. Flow-of-Control Optimizations

[7 marks]

End of Page